This listing of claims replaces all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (currently amended) An apparatus for <u>differential</u> spectral interferometry, said apparatus comprising<u>:</u>

an interferometer comprising a light source and an element ~~dithered to provide~~ <u>providing</u> a <u>dithered,</u> continuous relative phase shift between target and reference arms of ~~the~~ <u>said</u> interferometer<u>;</u>

<u>a detector synchronized with said element, said detector synchronously detecting an output from said interferometer and cooperating with one or more other elements of said apparatus to provide spectrally resolved detection; and</u>

<u>a processor that creates a differential spectral interferogram, said processor operating on data from said detector obtained at relative phase shifts separated by a phase shift difference</u>.

2. (original) The apparatus of claim 1 wherein said light source is mode locked.

3. (currently amended) The apparatus of claim 1 ~~additionally comprising means for~~ <u>wherein said processor creates said differential spectral interferogram by</u> subtracting spectra ~~that differ by said~~ <u>at said relative</u> phase shift<u>s</u> ~~to create a differential spectral interferogram~~.

4. (currently amended) The apparatus of claim 3 additionally comprising means for performing a Fourier transform of said differential spectral interferogram <u>wherein said phase shift difference is π</u>,

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~~whereby an amplitude of a signal of interest is improved by a factor of approximately two as compared to non-differential spectral interferometry~~.

5. (original) The apparatus of claim 1 additionally comprising means for determining both real and imaginary components of a complex interferogram.

6. (currently amended) The apparatus of claim 5 wherein said <u>processor improves signal-to-noise ratio by averaging a plurality of spectra</u> ~~means for determining substantially removes 1/f noise~~.

7. (currently amended) The apparatus of claim 1 wherein said element ~~comprises~~ <u>is dithered by</u> a piezo translator.

8. (currently amended) The apparatus of claim 1 ~~additionally comprising a~~ <u>wherein said detector is a multi-element</u> detector providing lock-in detection for each of one or more <u>elements of the multi-element detector</u> ~~pixels~~.

9. (currently amended) The apparatus of claim 1 wherein said phase shift <u>difference</u> is ~~approximately~~ π.

10. (currently amended) The apparatus of claim 1 wherein said apparatus <u>improves signal-to-noise ratio by averaging a plurality of spectra</u> ~~substantially rejects 1/f noise~~.

11. (currently amended) The apparatus of claim 1 wherein said apparatus <u>comprises a monochromator</u> ~~substantially rejects low frequency noise~~.

12. (currently amended) The apparatus of claim 1 wherein said apparatus ~~substantially~~ reduces detection bandwidth <u>to less than the phase modulation frequency</u>.

13. (currently amended) The apparatus of claim 1 wherein said apparatus <u>images biological material</u> ~~employs synchronous detection~~.

14. (currently amended) The apparatus of claim <u>1</u> ~~13~~ wherein said <u>detector employs</u> ~~synchronous detection comprises~~ lock-in detection.

15. (currently amended) An apparatus for <u>differential</u> spectral interferometry, said apparatus comprising:

an interferometer comprising a light source and an element ~~dithered to provide~~ <u>providing</u> a <u>dithered,</u> continuous relative phase shift between target and reference arms of ~~the~~ <u>said</u> interferometer; and

a <u>multi-element</u> detector providing ~~synchronous~~ <u>lock-in</u> detection for ~~each of one~~ <u>two</u> or more <u>elements of said multi-element detector synchronously with said relative phase shift</u> ~~pixels~~.

16. (currently amended) An apparatus for <u>differential</u> spectral interferometry, said apparatus comprising:

an interferometer comprising a light source and an element providing a relative phase shift between target and reference arms of the interferometer; ~~and~~

a <u>multi-element</u> detector providing ~~synchronous~~ <u>lock-in</u> detection for ~~each of one~~ <u>two</u> or more <u>elements of said multi-element detector synchronously with said relative phase shift; and</u> ~~pixels~~

<u>a display that displays target characteristics derived from plural differential spectral interferograms of said target derived from plural sets of spectra obtained at relative phase shifts separated by a respective phase shift difference.</u>

17. (currently amended) A method for <u>differential</u> spectral interferometry <u>of a target</u>, the method comprising the steps of:

providing an interferometer comprising a light source; ~~and~~

~~dithering~~ <u>employing</u> an element to provide a <u>dithered,</u> continuous relative phase shift between target and reference arms of the interferometer<u>;</u>

<u>detecting output from the interferometer synchronously with the dithering; and</u>

<u>generating a differential spectral interferogram from signals derived by the interferometer at relative phase shifts separated by a phase shift difference.</u>

18. (original) The method of claim 17 wherein the light source is mode locked.

19. (currently amended) The method of claim 17 additionally comprising the step of ~~averaging~~ plural differential spectral interferograms to provide an output characteristic of a position on the target ~~subtracting spectra that differ by the phase shift to create a differential spectral interferogram~~.

20. (currently amended) The method of claim 19 additionally comprising the step of performing a Fourier transform of the resulting differential spectral interferogram~~, whereby an amplitude of a signal of interest is improved by a factor of approximately two as compared to non-differential spectral interferometry~~.

21. (original) The method of claim 17 additionally comprising the step of determining both real and imaginary components of a complex interferogram.

22. (currently amended) The method of claim 21 additionally comprising the step of improving signal-to-noise ratio by averaging a plurality of spectra ~~wherein the determining step substantially removes 1/f noise~~.

23. (currently amended) The method of claim 17 wherein the element ~~comprises~~ is coupled to a piezo translator.

24. (currently amended) The method of claim 17 wherein the detector is a multi-element detector and additionally comprising the step of providing lock-in detection for each of ~~one~~ two or more ~~pixels~~ elements of [[a]] the multi-element detector.

25. (currently amended) The method of claim 17 wherein the phase shift is ~~approximately~~ π.

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26. (currently amended) The method of claim 17 additionally comprising the step of improving signal-to-noise ratio by averaging a plurality of spectra ~~wherein the method substantially rejects 1/f noise~~.

27. (currently amended) The method of claim 17 wherein the output from the interferometer is spectrally resolved ~~method substantially rejects low frequency noise~~.

28. (currently amended) The method of claim 17 wherein the method ~~substantially~~ reduces detection bandwidth to less than the phase modulation frequency.

29. (currently amended) The method of claim 17 additionally comprising the step of displaying characteristics of the target derived from plural differential spectral interferograms ~~employing synchronous detection~~.

30. (currently amended) The method of claim 29 wherein the ~~employing~~ displaying step is performed on biological tissue ~~comprises employing lock-in detection~~.

31. (currently amended) A method for differential spectral interferometry, the method comprising the steps of:

    providing an interferometer comprising a light source;

    ~~dithering~~ employing an element to provide a dithered, continuous relative phase shift between target and reference arms of the interferometer; ~~and~~

    providing lock-in detection for each of one or more ~~pixels~~ elements of a multi-element detector, the lock-in detection being synchronous with the relative phase shift; and

    determining a differential spectal interferogram from spectra obtained by the multi-element detector at relative phase shifts separated by a phase shift difference.

32. (currently amended) A method for differential spectral interferometry of a target, the method comprising the steps of:

    providing an interferometer comprising a light source;

    ~~dithering~~ employing an element to provide a dithered, continuous relative phase shift between target and reference arms of the interferometer; ~~and~~

    providing lock-in detection for each of one or more ~~pixels~~ elements of a multi-element detector, the lock-in detection being synchronous with the relative phase shift; and

    displaying target characteristics derived from plural differential spectral interferograms of the target derived from plural sets of spectra obtained at relative phase shifts separated by respective phase shift differences.

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